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STUDIES IN AUSTRALIAN THYSANURA

No. 4. MACHILIDAE (BRISTLE-TAILS)

By H. Womersley, F.R.E.S., A.L.S.

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The *Machilidae* or Bristle-tails, together with the *Lepismatidae* or Silverfish, form the ectotrophic division of the old order Thysanura. Apart from several primitive characters, however, they have very little in common with the entotrophic division which includes the families *Campodeidae, Japygidae* and *Projapygidae*. The present tendency of taxonomists is to regard them as two distinct orders, the *Ectotrophi (Thysanura* s. str.) and the *Entotrophi (Diplura)*.

The two families of the *Ectotrophi* may be separated as follows:—

Compound eyes large; ocelli present. Abdominal segments I-VII usually with one or two pairs of exsertile vesicles. Stylets present on sternites II-IX and usually on some of the thoracic coxae. Thorax generally well arched and not flattened. Body always scaled. *Machilidae*

Compound eyes small or absent. Abdomen usually with some stylets and exsertile vesicles. Thoracic coxal stylets absent. Body much flattened and fish-shaped, or elongate and parallel-sided. Body scaled or not. *Lepismatidae*

Bristle-tails or rock-jumpers are rare in Australia, but in many parts of the world they are to be found in large numbers. Such is the case along the coasts of Europe, where they frequent the sandstone cliffs. In other parts they can be found on and under stones on hilly woodsides, as on the lower slopes of Table Mountain, South Africa. Little is known of their food, but it apparently consists of minute algae growing upon the rocks where they are found.

These insects are moderately large, measuring up to three-fourths of an inch in body length, fish-shaped and of a brownish colour which often shows remarkable reflections as the light falls upon the scaling. They are furnished with two long filamentous antennae composed of from 30 to 40 segments, each of which may be subdivided into 10 to 14 small parts. Compound eyes are always present, generally of large size and touching each other in the medial line for more or less of their length. Below the compound eyes lies a pair of large ocelli of peculiar form, often being dumbbell-like or triangular with the broadest part near the middle line. More anterior still is a simple organ which is spoken of as the *single ocellus*.

In the head the epicranial suture can frequently be seen, and the labrum and clypeus are well developed. The mouth parts themselves are exserted and conform to the primitive type as exhibited in the more generalised of the higher

insects such as the cockroaches. The mandibles are simple in form, consisting of a single sclerite furnished with a well-developed molar plate and several apical teeth. These latter are often much worn by use and are renewed at each ecdysis. In general the mandibles show much similarity to the corresponding organs in some of the higher Crustacea. The superlinguae are well developed, each organ consisting of two lobes and a vestigial palp. The maxillae are conspicuous organs having a toothed lacinia and a hood-like galea and are furnished with a 7-segmented palp. In the male sex the first and second segments often exhibit specialised sensory organs. The labium or lower lip has a broad mentum and submentum, a paired prementum and a 3-segmented palp. Both glossae and paraglossae are present, each being divided into lobes. The terminal segment of the labial palp is supplied apically with sensory setae.

The thorax is comparatively large and considerably convex dorsally, sometimes being even gibbous. The coxal segments of the legs are large, and often the second and third pairs carry movable stylets, which have been correlated by some authorities with the exopodites of crustacean limbs. The tarsi are 3-segmented, ending in paired claws and sometimes having ventral scopulae of hairs.

The abdomen has eleven segments, the last ending in the long tail filament, while the penultimate segment carries the paired cerci. On some of the sternites are one or two pairs of exsertile vesicles, and also a pair of stylets. The median sclerite of the sternites may be large and triangular or more or less completely hidden by the coxal plates.

The genitalia are simple, usually consisting of one or two pairs of gonapophyses which, in the female sex, form the valves of a long ovipositor, and in the male are short and accompanied by a short median penis.

Of the life-history of these insects little is known except in the European genus *Petrobius*. In this there are at least six instars, each of which closely resembles the adult except in size. The first two instars, however, are entirely scaleless and without the thoracic coxal stylets of the later stages. There also appears to be a subimaginal instar in which the genitalia are developed but sexual maturation is not attained.

Classification of the Machilidae

The following three subfamilies are recognised, of which the first only is as yet known to occur in Australia:—

1. Abdominal segments all with median sternal sclerites almost if not quite invisible. At most each abdominal sternite with only a single pair of exsertile vesicles. *Meinertellinae*

   Abdominal segments II-VII with relatively large and visible triangular median sternal sclerites. 2

2. Only a single pair of exsertile vesicles on any one segment. *Praemachilinae*

   Some sternites with two pairs of exsertile vesicles. *Machilinae*

Subfamily MEINERTELLINAE

Two genera only, *Allomachilis* Silv. and *Machiloides* Silv. (= *Nesomachilis* Till.) are, so far, known to occur in Australia, while but a single representative of the latter is found in New Zealand. Careful search in the kinds of localities indicated above may reveal other genera and species, and for this reason the following key to the known genera of *Machilidae* is given:—

1. Exsertile vesicles present on sternites I-VII. 2
   Exsertile vesicles only on sternites II-IV. Legs II and III with coxal stylets. Paired ocelli triangular. Gen. *Allomachilis* Silv.
2. Coxal stylets on legs II and III. Paired ocelli transverse, elongate. Second segment of maxillary palp in male with subapical process and sensory setae or rods. Gen. *Machiloides* Silv. (= *Nesomachilis* Till.)
   Coxal stylets only on leg III or wanting. 3
3. Coxal stylets on leg III. 4
   Coxal stylets wanting on all legs. 6
4. Eyes large, much deeper than wide. Cerci slightly longer than body. Subapical process of palp II of male not hook-like Gen. *Megalopsobius* Silv.
   Eyes normal, wider than deep. 5
5. Coxal stylets on leg III reduced. Male gonapophyses absent. Gen. *Hypomachiloides* Silv.
   Coxal stylets on leg III normal. Gen. *Machilontus* Silv.
6. Male sex without tarsal scopulae. 8
   Male sex with dense tarsal scopulae. 7
7. Tarsal scopulae present in both sexes. Gen. *Meinertellus* Silv.
   Tarsal scopulae confined to the male. Gen. *Meinertelloides* Wom.
8. Paired ocelli not elongate, subrotund and almost touching lower margin of eyes. Gen. *Machilinus* Silv.
   Paired ocelli transverse. 9
9. Eyes large, deeper than wide. Paired ocelli transversely oblique. Median sternal sclerites almost invisible. Gen. *Macropsontus* Silv.
   Eyes normal. Median sternal sclerites visible. Male gonapophyses present or not. Gen. *Machilellus* Silv.

Genus ALLOMACHILIS Silv., 1904

Allomachilis froggatti Silv., 1904

Hitherto, this species was the only one recorded from Australia. It was described in 1904 by Prof. F. Silvestri from specimens collected by the late Mr. W. W. Froggatt on the coast of New South Wales. All the original specimens, however, were females.

Through the kindness of Prof. G. E. Nicholls the writer was able, while working at the University of Western Australia, in 1930, to examine about a dozen specimens of a Machilid collected by Prof. Nicholls and Mr. K. C. Richardson at Herring Cove, Two-people Bay, near Albany, Western Australia, in January, 1925. This material was labelled provisionally, *"Allomachilis,* sp. nov.," and again all the specimens were females. On re-examination it was possible to definitely identify the specimens with Silvestri's *A. froggatti.*

While holidaying in the Albany district in January, 1932, an attempt was made, with the aid of a friend acquainted with the district, to locate the spot where Prof. Nicholls had obtained his specimens, in the hope of finding the unknown male.

The habitat was found to be a small sandstone outcrop on the eastern end of Herring Cove; all the rest of the coast thereabouts being granite. About half a dozen specimens were seen, but owing to their extreme agility only two were captured. Of these, one was lost on the way back to Perth, but the other, on examination, proved to be a fully developed male. The following description of this sex deals mainly with the points in which it differs from Silvestri's description of the female:—

Description of Male—Dimensions, eyes, paired ocelli, antennae, thoracic and abdominal stylets and exsertile vesicles as in the female. Second segment of maxillary palpi simple and without sensory organs. Penis short; gonapophyses wanting.

Locality—Herring Cove, Two-people Bay, Western Australia, in January, 1932.

Remarks—This species also occurs in South Australia, where it has been found by the writer at Marino Rocks and at Yvonne Bay, Kangaroo Island. It has also been collected on Flinders Island, Bass Strait, Tasmania, by Mr. J. W. Evans.

Genus Machiloides Silv.

= *Nesomachilis* Tillyard, 1924

In 1924 the late Dr. R. J. Tillyard erected the genus *Nesomachilis* for a New Zealand species, *N. maoricus*. In his description and figures there appears to be no characters by which the genus can be separated from *Machiloides* of Silvestri. That this is so has been confirmed by the writer, who, through the courtesy of Dr. J. Millar, of the Cawthron Institute, Nelson, New Zealand, has been able to re-examine Tillyard's type material, as well as fresh material from Nelson, kindly supplied by Mr. J. W. Evans.

About 1934 Dr. Tillyard informed me that he was making a biological study of a species of Machilid which he had obtained from the neighbourhood of Brisbane. Upon request he kindly sent a number of specimens for specific determination. Study of this material showed that, while closely allied to the New Zealand form, it belonged to a new and distinct species.

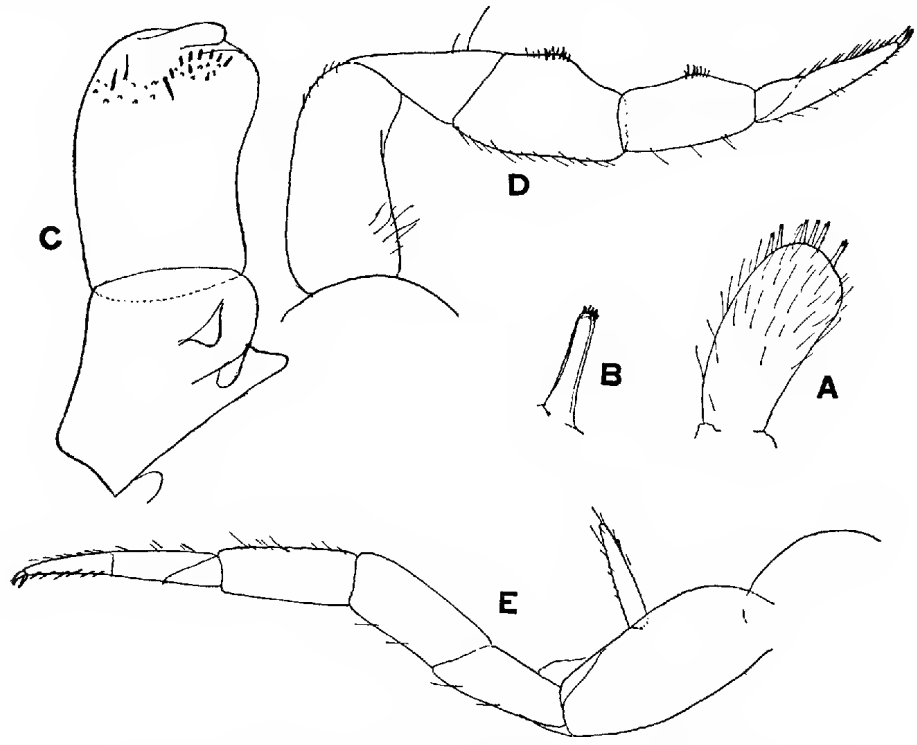
In the collections of the South Australian Museum was a single carded Machilid labelled "Stanwell Park, New South Wales," which had possibly been collected by A. M. Lea many years ago. On dismounting and dissecting, this specimen was found to be a female of the Brisbane species. Two other females, collected by Miss M. E. Fuller at Sydney in 1933, are also of the same form.

Description of the new species is as follows:—

Machiloides australicus n. sp.

(Text fig. A-E)

Length of body to 7 mm. Colour in spirit brownish, in life probably dark fuscous. Antennae thin, except the basal segments, reaching to two-thirds length of body; basal segment twice as long as broad, distal segments with 9-10 subdivisions. Eyes large, round, touching medially for two-thirds of their depth. Paired ocelli pear-shaped, transverse, widely separated medially. Labial palpi normal, apical segment with few but large setae or rods (fig. A-B). Maxillary



Machiloides australicus n. sp. (Male)
A, apical segment of labial palp; B, a single sensory seta from apex of above; C, first and second segment of maxillary palp; D, leg I; E, leg III.

palpi with the usual triangular and bulbous processes on segment I; II in the male with a subapical bent parallel-sided lobe, below which are a number of short, blunt, black rods; below these rods are some black-pointed setae which extend right across the segment. This structure somewhat resembles that described by Evans in 1927 for *M. maoricus* (Till.), but in the latter species the rods are placed in a distinct pocket formed by the subapical lobe and do not lie free as in the new species (fig. E). The remaining segments of the maxillary palpi are simple. The relative lengths of the segments of the maxillary palpi are:—male,

17 : 20 : 23 : 20 : 32 : 25 : 20; female, 10 : 15 : 13 : 13 : 20 : 15 : 15; lacinia shorter than galea. Mandibles normal with toothed apex and well developed molar plate.

Thorax moderately arched; legs I strong and somewhat raptorial, the femora and tibia being swollen inwardly, II and III longer and thinner with well developed stylets on coxae.

Abdominal segments with median sternal sclerites practically invisible, II-VII with a single pair of exsertile vesicles, II-IX with stylets, those on IX twice as long as those on VIII and with the apical seta two-thirds of their length. Median tail appendage two-thirds of body length, cerci rather shorter.

Male: penis short, gonapophyses absent.

Female: ovipositor short, annulated, scarcely reaching tip of ninth stylet.

The whole body is heavily scaled, the scales arranged in the manner described by Evans for *M. maoricus* (Till.).

Remarks—In the original description of *M. maoricus* the exsertile vesicles are given as present on sternites I-IX. This is a printer's error, for in no species of *Machilidae* so far known do these organs occur beyond sternite VII. The new species described above is a rare and apparently very local one. It appears to be an inland and not coastal form and should be searched for in stony woods.

References to Literature

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